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CAN THE MOSQUITO BE EXTERMINATED ?

BY HENRY C. M'COOK, M. D.

NATURAL SCIENCE has taught the world modesty in its judgments. Many things thought impossible have been done, and the imaginary achievements of the genii and magicians of earlier ages are the work-a-day deeds of modern times. Therefore one may well hesitate to say that the extermination of the mosquito is impossible; yet the facts seem to point that way. The mosquito is an ancient inhabitant of this globe of ours, being found among the fossil insects, and is as catholic in its distribution as venerable in its descent. Having thus far held a place among the myriad creatures of our globe, it is likely to continue its generation. Let us, then, accept it as inevitable that the mosquito cannot be exterminated.

Can the mosquito pest be mitigated ? That is quite another question, which has just been raised by a philanthropic gentleman with strong scientific tastes. Dr. Lamborn, who has recently offered a prize for a preliminary study of the habits of dragon-flies, with a view to their propagation as destroyers of mosquitoes, has found the ready ear of the American nation. His manifesto was a "touch of nature" which has proved our New World "kin," for, alas ! there are few portions of this beautiful domain where the mosquito has not piped her war-song and drawn blood from human victims. I am constrained by truth, despite the seeming discourtesy, to say "her." It is the female mosquito that does all the damage ! Her spouse is a harmless creature. Without claiming any knowledge as a specialist of these very interesting but disagreeable insects, I may offer a few suggestions intended to encourage public sympathy and coöperation with an enterprise which may seem to many chimerical. Certainly nothing is ever done by attempting nothing ; and if

we wish to rid ourselves of what is an undoubted pest in certain localities, we must at least "make an effort." Success in limiting the number of mosquitoes pivots upon two points: Hostile Environment and Natural Enemies.

I.

Where the conditions are favorable for propagation and growth, the mosquito, like other creatures, will flourish. If those conditions can be made unfavorable, the insect must decrease. This compels us to ask, What are favorable conditions for the mosquito's development?

The question is easier asked than accurately answered. In point of fact, the mosquito has a cosmopolitan distribution. It is supposed to have its paradise in tropical countries, but it flourishes in Labrador. It affects low-lying positions, but lovers of the Adirondack Mountains will recall visions of "smudges," and cheese-cloth canopies on rustic banks, and battles with swarms of culicidæ amid the souging of pines and the sweet fragrance of the balsam. It loves the interior, and many a veteran may recall the days when he hunted prairie-chickens on the plains of Illinois with mosquito-netting twisted around his hat and face; yet it is said, though good testimony could be drawn to the contrary, that "a few" mosquitoes have habitat along the seashore of New Jersey! But wherever found, one condition seems to be essential to its active development. It must have water.

The mother mosquito deposits her eggs in minute boat-like masses upon the surface of water. From these eggs come little larvæ, or worms, or maggots, to use popular words. These wee things inhabit the water, living most of the time at or near the bottom, where they are said to feed upon decaying matter and the micro-organisms that swarm in such conditions. The question has often been asked me, "What were mosquitoes made for, anyhow?" If those who have specially studied the habits of the insects are correct, they certainly render important and useful service during their larval stage by cleansing swamp lands and stagnant pools from the miasms which plague mankind with various forms of fever. Let this much be said to the credit of this dreadfully maligned insect, for it behooves the naturalist, at least, to give "even the devil his due." If our mosquito were only

pleased to confine its existence to this stage, there would be no need to write this paper, for it would be numbered among the benefactors of our race, or, perhaps, like many another benefactor, be utterly unknown.

The mosquito's brief period of larval life is divided between feeding upon the aforesaid micro-organisms, etc., and occasional excursions to the surface for a breath of air. Unfortunately, the larva soon becomes a pupa with a greatly enlarged thorax, which gives the body a club-shaped appearance. Two broad paddles or caudal swimming leaves are fixed at the apex of the body, by which the mosquitoes can wiggle their way through the water. They are active in their habits, but they do not eat. Perhaps their larval diet of miasms proves too much for them. Soon they awake at the call of Nature to another element and another sphere of activity.

It may shock the æsthetic sensibilities of the general public to speak of anything beautiful or fairy-like in the natural history of the mosquito; but really such terms are truly applicable when the mosquito pupa begins to transform. Let me briefly describe the process as entomologists have observed it. These little fish-like larvæ have spent their first stage of being swimming about in stagnant water, devouring the living atoms that swarm therein. They reach their second stage by casting off the larval skin and becoming pupæ. In this stage they remain rolled up like a ball, and float at the surface of the water for the purpose of breathing through the two respiratory tubes on the top of their backs. If disturbed by any unwonted agitation of the water, they suddenly uncurl their bodies and whirl over and over from side to side. This turn-verein existence, spent with no sustaining nutriment but atmospheric air, terminates in the course of a few days.

Now the little water-tumblers are ready for another transformation. The skin splits on the back between the breathing-tubes, and a little boat is thus formed, as gracefully curved at the bow and poop as the imperial barge of Cleopatra. Out of this fairy bark there suddenly issues a winged creature. The head, the body, the limbs, burst from the opening in the hard skin. The slender legs are raised on the edges of the empty bark until, spreading its wings and pluming itself for flight into sunlight and air, the insect rises, while by the reflex of its upward bound its tiny bark is overset and sinks beneath the wave. If the poet

or artist were to catch this vision at the moment the insect leaves its abandoned bark and stretches its wings for flight, he might well imagine that he had obtained a glimpse of the good old days when one might see "old Proteus" or young Venus "rising from the sea." Alas, that Professor Gradgrind, the naturalist, should be compelled to tell him that he had only seen a mosquito transforming!

This is the natural history of the animal's environment. The practical question is, How can one so control these conditions as to limit the multiplication of the insects? Obviously the answer is, Limit their natural breeding-grounds! When swamps are dried up, when stagnant pools are filled up, when brackish lakes and sluggish streams are drained and dredged and graded so as to give free current to their waters, when the swamp grasses, weeds, sedges, and various plants in which mosquitoes find refuge after transformation are cut down and cleared away,—when, in short, the scythe, lawn-mower, grubbing-axe, and gardener's hand of diligence, thrift, cleanliness, and care have turned our country into a cultivated garden, the days of the mosquito as a pest will be numbered. *Culex pipiens* and all the other species of culicidæ (the family of mosquitoes and gnats) will still have their representatives in the land; but they will be shorn of their power to deplete the veins of summer cottagers and guests and the purses of summer landlords.

II.

The second factor in limiting the number of mosquitoes is that of natural enemies. Of these only two may be mentioned—the dragon-fly and the spider. It is a strange illustration of human perversity that these two animals, whose lives are spent in serving man, should be largely under the ban of human prejudice. The dragon-fly is dreaded; the spider is hated; and yet they are nature's checks upon the mosquito and other insects that otherwise would make our earth well-nigh uninhabitable.

Is it practicable so to develop the dragon-fly and spider that their special gifts from Nature can be further used in the service of man by directing them especially against the mosquito? The first step in the practical consideration of such a question, of course, is that human prejudice should be set aside and these two animals recognized in their true relations to the insect world.

Dr. Lamborn's circular concerning the propagation of the dragon-fly, which has evoked this inquiry, will doubtless call forth a great deal of valuable information from entomologists better equipped for treating the subject than myself. But a few words on this point may not be out of place. "What is a dragon-fly?" asked an intelligent city gentleman who had read Dr. Lamborn's note. I attempted to explain, and, indeed, took the pains to show him a figure of the insect. "Oh!" was the exclamation, "that's a devil's darning-needle!" Yes; and the name is expressive of the attitude of English-speaking people towards this serviceable insect. I have read of a school—if memory serves me truly, it was situate in that highly-developed centre of American civilization, New York City—whose session was broken up by the advent of an innocent dragon-fly through an open window. An alarm raised by one scholar passed through the entire room: "A devil's darning-needle! A devil's darning-needle!" The ominous phrase, piped in the shrill quaver of terrified childhood, alarmed the teacher, and the agitation became so general that the school had to be dismissed as an act of humanity.

Again, I well remember, when a small boy upon the hill of eastern Ohio, gazing with open-eyed wonder upon the beautiful forms of these insects as they flitted to and fro, and heard my older companions speak of them as "snake-feeders." "Look out! There's a snake somewhere near! Here's a snake-feeder!" I do not even now know the origin of that term, or the meaning attached to it by people generally; but to my child's imagination there came up a picture of these strange insects haunting some shady nook by running streams, where, under the shelter of limestone rocks, the serpent reared his head and thrust out his quivering tongue to receive his daily supplies of food from his servant, the "snake-feeder." Is it strange if boyish fancy somehow associated the incident with all sorts of demoniac folk-lore and ghost-stories? And yet, within two weeks from the date of this writing, a well-informed gentleman who did not know this insect by the name of dragon-fly recognized it at once when I spoke of it as a "snake-feeder." With a keener sense of the beautiful, the French have called this insect *demoiselle*. But for the most part English terminology expresses superstitious fear or ignorance.

There is, however, another popular name which shows that the kindly service of these beautiful neuroptera, the libellulidæ,

is known and appreciated. It is "the mosquito-hawk." Those who have watched the dragon-fly's habits must have noticed that, as it flits here and there, it is engaged in seizing and devouring various insects. In regions infested by mosquitoes, those creatures contribute largely to the dragon-fly's appetite. This deadly war, waged in its perfect estate upon the perfect form of mosquito, is only a continuation of the habit of larval life. Like the mosquito, the mother dragon-fly oviposits in the water, and its young are reared under similar conditions. The dragon-fly larva is as voracious as the imago, and destroys enormous numbers of the aquatic larvæ of other insects, including, of course, the larvæ and pupæ of mosquitoes. Thus it comes about that in both stages of their development dragon-flies are the natural enemies of the mosquito in both stages of its life.

Now emerges the query, Can this "mosquito-hawk" be propagated in such numbers, in regions most frequented by the mosquito, as materially to contribute to the mitigation of the pest? The question is one that can only be answered by experiment, and certainly the interests involved to both human property and human comfort are sufficient to justify the undertaking. There appears to be no difficulty in rearing the aquatic larvæ and pupæ of dragon-flies in artificial conditions. An ordinary aquarium, a good-sized jar, or a glass tumbler will suffice for a successful experiment. The matter which needs most to be attended to in such primitive undertakings is to separate the more ferocious forms from the less.

Dr. Lamborn's offer of a prize for a paper upon the methods of propagating dragon-flies is intended simply as a preliminary step. If the inquiry should develop facts that seem sufficient to justify further experiments and researches, no doubt there will be money enough forthcoming to enter upon this larger undertaking. In the meantime let us encourage the endeavor. It can certainly do no harm. It will, beyond doubt, develop many interesting facts in natural history; and if it shall fail to reach its objective point, it will at least have enlightened the nation somewhat as to the real character of one of the most beautiful and serviceable inhabitants of our insect world.

I now come to another natural enemy of the mosquito, concerning whose habits I can speak with something more of authority. The spider is Nature's chief check against the undue in-

crease of insects. Despised *Arachna* is entitled by her services to occupy the chief place among invertebrate philanthropists. It is, I might almost say, absolutely harmless to mankind. With the exception of an occasional alleged "spider bite" issuing in suffering or death, and delivered by the traditional and indefinite "black spider," I know of no evil that can be charged against the spider. True, as, long ago, the wise Proverbialist said, "She taketh hold with hands, and is in king's palaces." She builds her cobwebs in our homes, but there is no harm in that. If one will take the pains to study the cobwebs, they will be found beautiful structures; and, at all events, the housewife can brush them away without encouraging hatred for the harmless creature that makes them. For, be it considered, the spider only comes into our homes because mosquitoes and other insects also come ! She comes, not seeking to harm us, but to help us, and therefore for the sake of her motive, if she be not welcome, let her, at least, be thought of kindly.

The number of insects of all sorts and sizes destroyed by spiders simply passes calculation. If one will walk out on a dewy morning, with his eyes open for spider-webs, he will be surprised to find how many there are, and how various, too, the forms of spinning-work that meet him. All over this new-ploughed field he will find them ; in yonder meadow, also, hanging by myriads upon myriads on the grasses. Along that hedgerow they are nested and have woven their dainty snares. In the branches of these shrubs and on the foliage of yonder trees are other hosts. If one will push back the foliage, he will see yet others, spiders of the wandering group, that stalk their prey as do the wild beasts of the forests, crouching on trunk and branches and lurking among the leaves. If one turns to the earth, other myriads are seen whose homes are on the ground, or who build slight webs close to the surface. These have laid the axe at the very root of the tree, and are destroying the insects ere they rise from the surface to visit our homes. All these unnumbered multitudes of spiders are engaged during every moment of their existence in waging relentless war upon the insect world. When one considers how many spiders there are, and that they all thus feed upon their natural food, the insects, he may form some just conception of how needful they are to mankind. I do not hesitate to say that, unless Nature should provide some equivalent in

the way of check upon insects, man could not dwell in many inhabited parts of the world were it not for the friendly service of spiders.

But do the spiders have a special taste for mosquitoes? it may be asked. They take what comes to them, and when mosquitoes are abundant mosquitoes are taken. I have counted in an orb-weaver's snare, spun upon the railing of the long bridge over Deal Lake, New Jersey, thirty-eight mosquitoes at one time hanging entangled upon the viscid spirals. Times without number have I seen like destruction wrought to mosquitoes by spiders' webs; for it is a fact that, even after the aranead has satisfied its appetite, its snare continues to capture insects. On one occasion I took the pains to count the number of insects of various species upon one large web which was spread in a favorable position, and found that there were two hundred and thirty-six. It is a most common thing to observe three, four, or half a dozen flies or other insects trussed up upon the viscid orb of some of our orb-weaving species. It is needless to add the conclusion from the above facts: if people would decrease the number of mosquitoes, let them encourage the multiplication of spiders.

The writer of this paper has not aimed to enter learnedly or exhaustively upon the subject, but simply to give a few hints by way of indicating the lines along which we may successfully consider the question, Can the mosquito be exterminated?

HENRY C. MCCOOK.